IPv6 in Public Clouds

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Who is Ivan Pepelnjak (@ioshints)

Past

- Kernel programmer, network OS and web developer
- Sysadmin, database admin, network engineer, CCIE
- Trainer, course developer, curriculum architect
- Team lead, CTO, business owner

Present

- Network architect, consultant, blogger, webinar and book author

Focus

- SDN and network automation
- Large-scale data centers, clouds and network virtualization
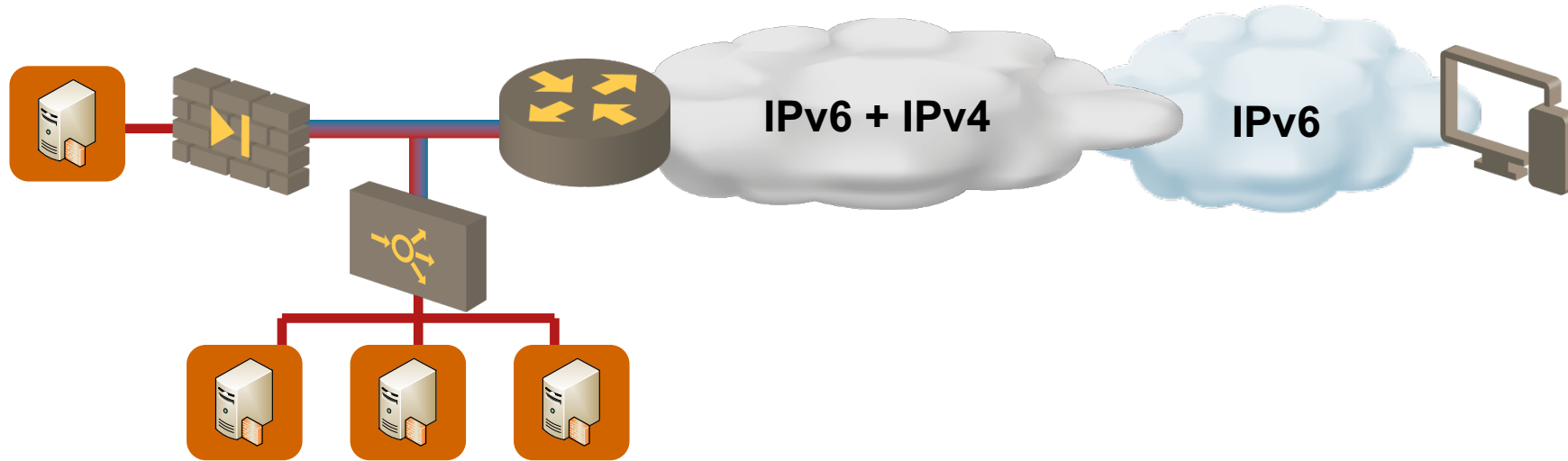- Scalable application design
- Core IP routing/MPLS, IPv6, VPN

The Good News: It All Works…

Functionality	AWS	Azure
IPv6 in virtual networks	✓	✓
IPv6 addresses in virtual machines	✓	✓
Bring your own addresses (BYOA)	✓	✓
Static (user-defined) routes	✓	✓
Internet access	✓	✓
Security groups	✓	✓
Subnet-level packet filters (ACLs)	✓	✓
IPv6-only virtual network	✓	✗
NAT64/DNS64	✓	✗

The Bad News: …for Baseline Connectivity Services

Functionality	AWS	Azure
Network (L3/4) load balancing	✓	✓
Application load balancing	✓	✗
Web Application Firewall	✓	✗
CloudFront / Front Door	✓	✓
Cross-protocol load balancing (SLB64)	✓	✗
Virtual network peering	✓	✓
Direct Connect / Express Route	✓	✓
VPN Gateway (IPsec)	✓ (IPv4 only endpoints)	✗
Transit Gateway / Virtual WAN	✓	✗
TGW Connect / Route Server	✓	✗
Private Link	✗	✗ (?)
Containers	✗ (?)	✗ (?)

Disclaimer: based on publicly available documentation as of early December 2021

Minimum-Effort IPv6 Deployment

IPv6 toward the Internet, IPv4 internally

- Trivial with AWS: ALB and WAF are IPv6-aware
- Hard with Azure: ALB is IPv4-only, WAF is an add-on to ALB. Front Door might help.

Fun Part:
Cloud Networking Is Different
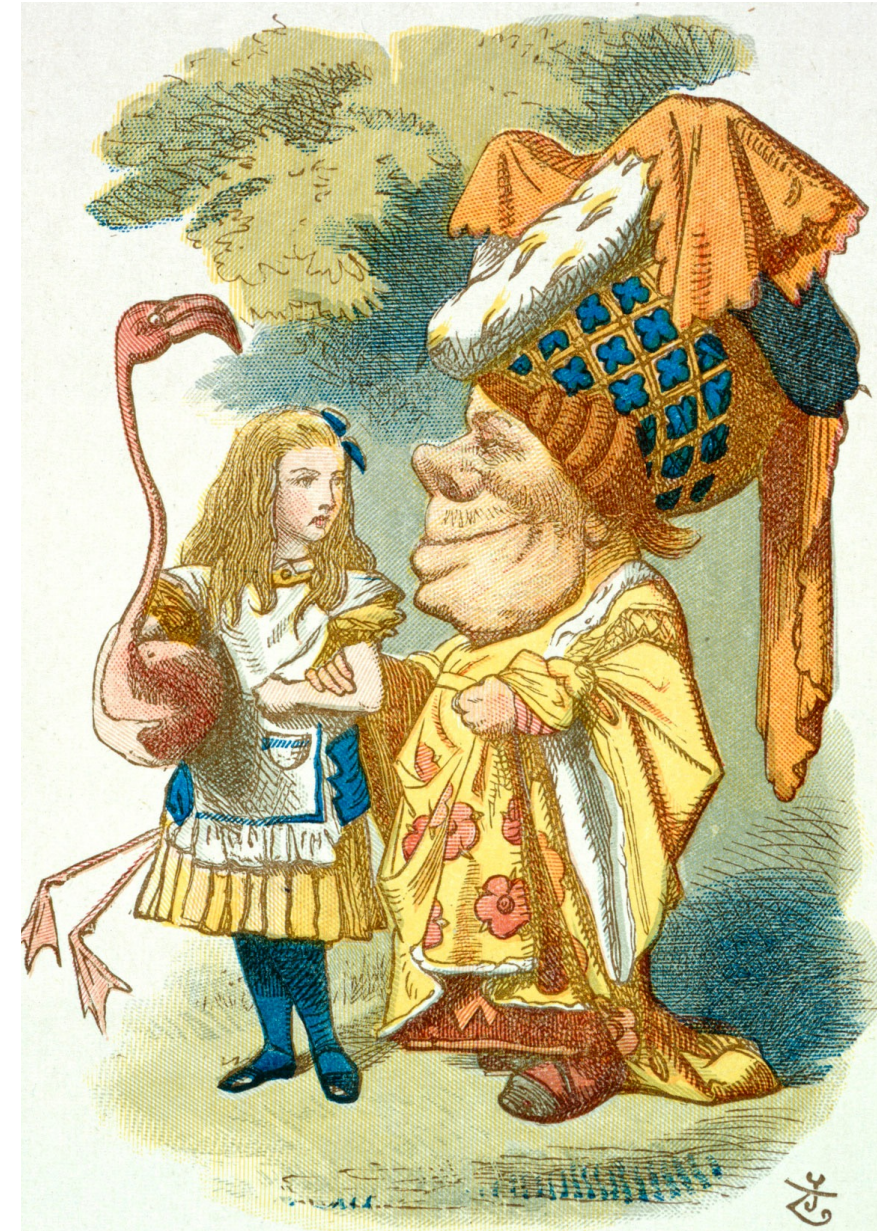
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What a Weird Land We're Entering

- There's no layer-2 in (sane) public cloud
- MAC, IPv4 and IPv6 addresses are assigned by orchestration system

Within a subnet

- AWS: unicast L2 forwarding
- Azure: unicast routing (L2 information is ignored)

Consequences

- No multicast
- No random address assignment

Impact on IPv6

- Link-local addresses don't work
- No SLAAC
- No duplicate address detection
- Neighbor discovery is somewhat limited
- Router Solicitation doesn't work

Consequences

- Virtual machines have to wait for periodic Router Advertisements
- Communication using LLAs doesn't work
- The only way to assign an IPv6 address to a VM instance is via DHCPv6
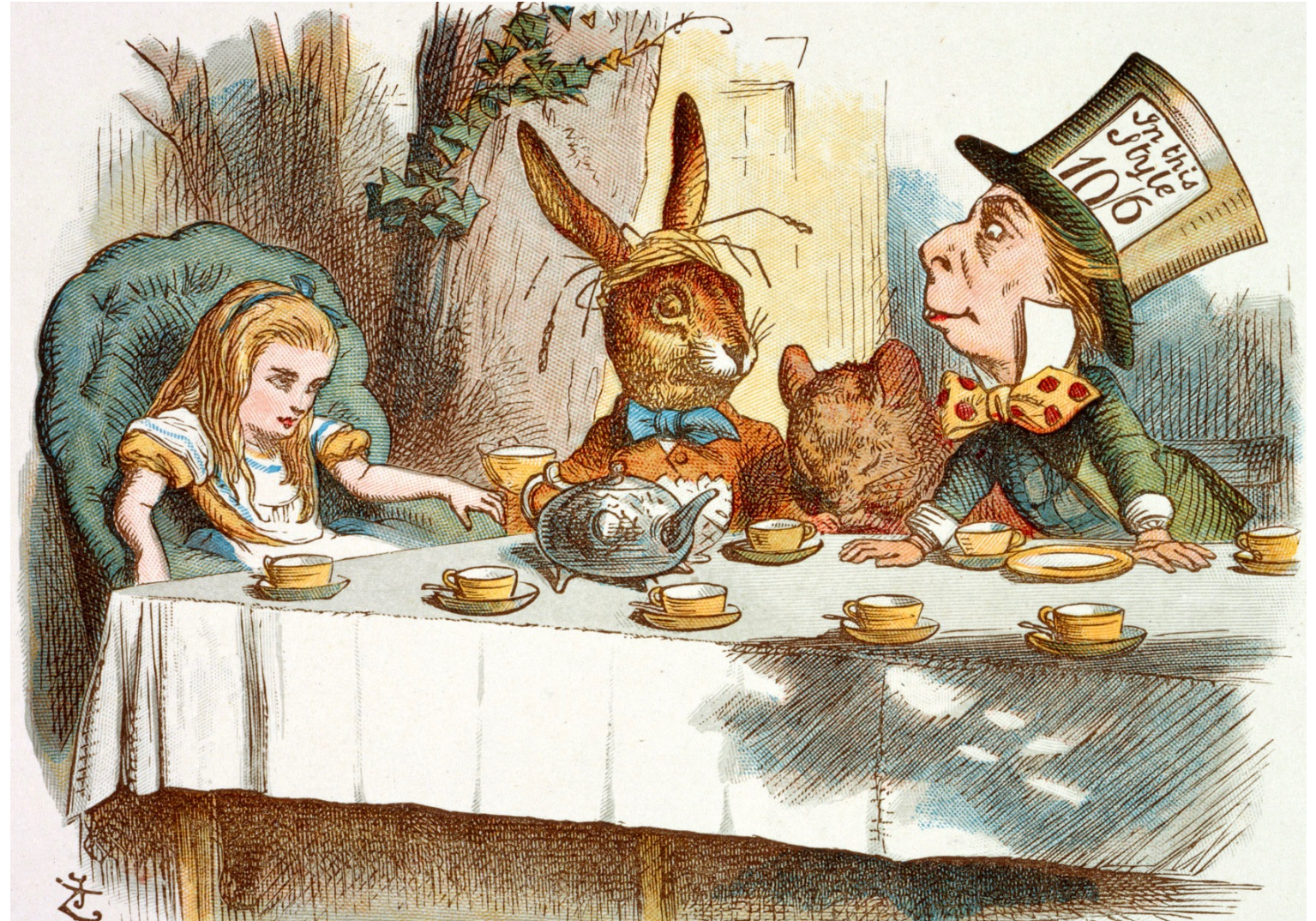
FUN FACT: GOOGLE CLOUD IPV6 ADDRESS ASSIGNMENT

When you enable IPv6 for a VM, the VM is allocated a /96 IPv6 address range. **The first IP address in that range is assigned to the primary interface using DHCPv6.**

Questions?

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